PREFACE

Textile composite structure has emerged as huge category of composite materials which is known for its adaptability and ease of making due already available traditional methods of manufacturing. Textile structures are engineered and fabricated to meet worldwide structural applications. Textile composite being anisotropic in nature exhibit different behaviour in terms of properties in different directions. These properties vary with different orientation with principal axes. This variable behaviour can be for better properties enhancement. Owing to higher costs and occasional limitations in both physical and chemical properties, it has been increasingly important to use composite materials as hybrid parts. A general designer or manufacturer requires a simple and reliable method to estimate the mechanical properties of composites for relevant applications, mainly based on the fundamental constituents' properties.

To reduce the high cost of high-performance fibres like Carbon and Kevlar, hybrid composites were prepared using HDPE yarn. The present work also encircles the idea of establishing a methodology for economical production of composites. Accordingly, the primary purpose of this work was to prepare hybrid woven fabric on laboratory scale. Hybrid woven fabric like Carbon-Carbon, Carbon-HDPE and Kevlar-HDPE were produced. The effects of skew angle, weave structure and type of reinforcement on the physical and mechanical properties of resulting textile polymer composite laminate (TPCL), prepared by hand layup technique, were investigated.

Present thesis consists of **Six Chapters.**

Chapter One covers introductory part.

Chapter Two deals with literature survey for the present work.

This chapter includes broad review of the published work about composite, textile reinforced composite, classification of composite materials based on their matrices, laminates, lay-up sequences, importance of lay-up sequences. Literatures based on different testing methods for mechanical properties like tensile, flexural, impact and damage resistance and physical properties like density and fibre volume fraction. Literature about the different parameters that effect these mechanical and physical properties. It also deals with literature review of importance of Scanning electronic microscope (SEM) and its method of testing. Lastly it

gives insight about the applications of composite materials. It also reviews the past and recent modelling techniques relating to the mechanical behaviour of polymer textile composite laminates with focus on woven fabric textile reinforcement.

Chapter Three describes the methodology of experiment which is adopted in this work. It is described in three sections:

Section I: This section deals with the preparation of woven fabric on sample loom. It is devoted to modifications done on CCI sample loom to successively weave different hybrid fabrics (Carbon-Carbon; Carbon-HDPE (plain, twill and sateen) ; Kevlar-HDPE). It also deals with the changes made on single end warping machine for proper unwinding of the tow.

Section II: This section deals with the preparation of textile composites using hand lay-up technique, by stacking the layers of hybrid fabrics differently at varied skew angles, weave structure and reinforcing yarn.

Section III: This section deals with the testing and analysis of prepared hybridised composites for physical and mechanical properties such as tensile, flexural, impact and damage resistance were done. It also describes ~~about the~~ SEM analysis ~~method~~.

Chapter Four deals with tabulation of the results and their analysis. It presents an elaborate discussion on physical properties and mechanical properties of all developed samples like tensile strength, flexural strength impact strength and damage resistance strength. A comparative analysis of mechanical properties between each sample was addressed. The chapter also presents the microstructural defects and enhancement of those defects in the selected samples.

Chapter Five deals with numerical simulation of tensile properties of textile polymer composite laminates using FEM analysis and ANSYS software.

Chapter Six deals with the conclusion about this research work. It consists of detailed conclusion of the results obtained from this study. It also includes suggestions for the future scope of the work.

Appendices and references are given at the end.